

## PATENT ABSTRACTS OF JAPAN

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(71)Applicant : KOBE STEEL LTD

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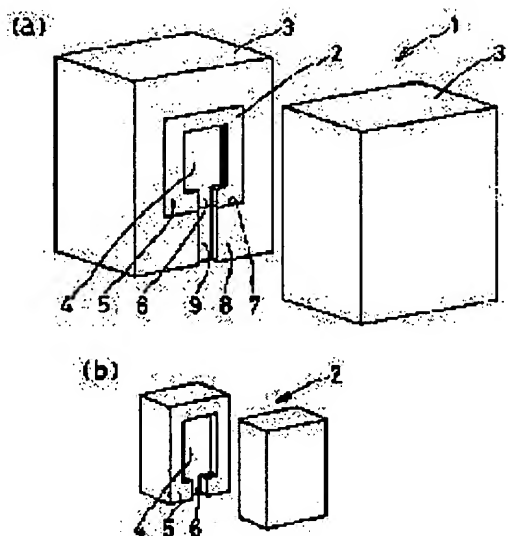
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## (54) DIE TO BE USED FOR DIE CASTING OF CAST IRON

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To prevent generation of cracks in a formed body by using a composite die comprising a sand die (insulated die) to form a cavity and a die to reinforce the sand die as a die in performing the die-cast forming of cast iron to greatly reduce the thermal load of the die and suppress generation of the cementite structure in the die casting.

**SOLUTION:** A die basically comprises a sand die 2 and a die 3. A cavity 4 is formed inside the sand die 2 to the shape of a formed body, and a runner 6 to be communicated with the cavity 4 is provided in a mating surface of the sand die 2. The outer contour of the sand die 2 is approximately of parallelepiped shape. The die 3 is made of the metal such as steel and copper, the sand die 2 is inserted therein, a recess 7 to reinforce the sand die 2 is provided, and a runner 9 to be communicated with the runner 6 formed in the mating surface 5 of the sand die is provided. A shell mold, ceramics die, etc., can be used in addition to the sand die, and for the practical application, the heat conductivity is preferably  $\leq 10$ -2cal/cm.sec.deg.



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**CLAIMS**

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[Claim(s)]

[Claim 1] Mold which is the mold used for die casting of the cast iron which injects, carries out pressurization maintenance and fabricates cast iron to mold, and is used for die casting of the cast iron characterized by mold consisting of metal mold which backs up heat insulation mold and this heat insulation mold.

[Claim 2] Mold with which heat insulation mold is used for die casting of the cast iron according to claim 1 which it comes to prepare in a part.

[Claim 3] Mold used for die casting of the cast iron according to claim 1 with which heat insulation mold consists of a sand mold.

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the mold used for die casting of cast iron.

[0002]

[Description of the Prior Art] Although there is a thing of various gestalten, such as a horizontal type and a vertical mold, as a die-casting facility, the basic configuration consists of injection equipment 11 and metal mold 12 like the vertical mold die-casting facility shown in drawing 6 with a schematic diagram, and injection equipment 11 is equipped with the injection cylinder 13, a plunger 14, and the injection sleeve 15, and, as for metal mold 12, the product cavity 16 is formed. And teeming of the molten metal 17 is carried out to the injection sleeve 15, after advancing metal mold 12 to this injection sleeve 15 and setting to it, the advance drive of the plunger 14 is carried out, while injecting a molten metal 17 in a cavity 16, predetermined time pressurization maintenance is carried out, after an appropriate time, metal mold 12 is retreated, a product is taken out and die casting is performed. It is usually manufactured with metals, such as die steel (for example, SKD61), die casting is preceded, and the metal mold 12 used for this die casting is usually a number. The preheating is carried out to 100 degrees C.

[0003]

[Problem(s) to be Solved by the Invention] By the way, in the above-mentioned die casting, when a molten metal 17 is the cast iron slurry of a solid-liquid coexistence temperature region, even if it is molten iron, or carries out the preheating of the metal mold 12 to several 100 degrees C and uses it for them in advance of die casting, since the temperature of molten iron or a cast iron slurry is an elevated temperature 1100 degrees C or more, it will quench within metal mold 12, and it will become easy to produce iron-cementite system coagulation for this quenching, and the cementite organization where a degree of hardness is high will generate. Since it is a high degree of hardness when this cementite organization generates, it becomes easy to produce a crack for a die-casting product. For this reason, in the product with which we are anxious about such a crack, it heat-treats anew after die casting, and reduction of a crack is achieved, while making a cementite organization change into a graphite organization and reducing a degree of hardness.

[0004] On the other hand, in the usual casting of cast iron, molten iron is slushed into mold and a cast product is manufactured. In this case, in order to use for die casting which mentioned above the mold which consists of this sand mold, since mold does not have the reinforcement which can oppose welding pressure, it is inapplicable [ mold ] to die casting, although a sand mold is usually used with a sand mold.

[0005] Then, a graphite organization is made to generate, without making this invention under the situation like \*\*\*\*, and controlling that a cementite organization generates the purpose during die casting, with heat-treating anew, and the mold used for die casting of the cast iron which can manufacture a cast iron product with few cracks is offered.

[0006]

[Means for Solving the Problem] The mold used for die casting of the cast iron concerning this invention in order to attain the above-mentioned purpose is mold used for die casting of the cast iron which injects, carries out pressurization maintenance and fabricates cast iron to mold, and consists of metal mold with which mold backs up heat insulation mold and this heat insulation mold.

[0007] And in the mold used for die casting of the cast iron concerning above-mentioned this invention, heat insulation mold may be formed in the part, or heat insulation mold may consist of a sand mold.

[0008] A cast product with few cracks can be obtained in this invention, without a graphite organization's generating and heat-treating anew at the same time quenching of the molten iron injected by the cavity is eased and generation of the cementite organization under die casting is controlled since heat insulation mold is used. Moreover, since metal

mold sticks to the outside of heat insulation mold and it is prepared, the welding pressure applied to heat insulation mold at the time of die casting can be backed up, it is stabilized and a cast product with few said cracks can be manufactured. Moreover, heat insulation mold is fabricated about the part which is easy to quench a cast iron product, and even if it is good also as a configuration which backs up the heat insulation mold with metal mold and such, a cast product with few cracks can be obtained, without controlling generation of a cementite organization and heat-treating anew.

[0009] Moreover, in this invention, since the heat insulation mold backed up by metal mold does not quench the cast iron slurry of the molten metal injected to the cavity on the occasion of die casting, or a solid-liquid coexistence temperature region, the phenomenon in which a molten metal and a cast iron slurry blow off from the joint of a mold is controlled, and it leads also to reduction in weld flash further.

[0010] Moreover, the mold concerning this invention is applicable to both the CHIKUSO cast method which heats and carries out die casting of the cast iron material (billet) to a solid-liquid coexistence temperature region the LEO cast method for injecting the cast iron slurry of a solid-liquid coexistence temperature region into a direct die-casting sleeve and the method of injecting the molten metal beyond liquidus-line temperature into a direct die-casting sleeve.

[0011]

[Embodiment of the Invention] Hereafter, the gestalt of operation concerning this invention is explained with reference to a drawing. Drawing 1 is the explanatory view of the mold concerning this invention, and the whole mold perspective view which a requires for this invention, and b are the perspective views of the heat insulation mold which consists of a sand mold concerning this invention.

[0012] The mold 1 concerning this invention consists of fundamentally a sand mold (heat insulation mold) 2 and metal mold 3, and a cavity 4 is fabricated according to the configuration of a cast iron product inside a sand mold 2, and the runner 6 which is open for free passage to a cavity 4 is fabricated by the mating face 5 of a sand mold 2. Moreover, the appearance of a sand mold 2 is fabricated in general by the rectangular parallelepiped. In addition, although the sand mold 2 is made into the example in this example, a shell mold, a ceramic mold, etc. can be used suitably and its quality of the material of 10-2cal / (cm, sec, and deg) following is good for others at thermal conductivity practical. Incidentally, the thermal conductivity of a sand mold is 3cal/ [ 1.5x10-] (cm, sec, and deg) [however, a room temperature] extent.

[0013] On the other hand, the hollow 7 for metal mold 3 consisting of metals, such as steel and copper, making a sand mold 2 insert in the interior, and backing up is formed, and the runner 9 which is open for free passage to the runner 6 fabricated to the mating face 5 of a sand mold 2 is established in the mating face 8 of metal mold 3. In addition, the thermal conductivity which is the metal mold (SKD61) and metal mold (SUS304) which are conventionally used widely is each. They are 1.2x10-1cal/(cm, sec, and deg) [however, a room temperature], and 2cal/ [ 3.6x10-] (cm and sec-deg) [however, a room temperature] extent.

[0014]

[Example]

[Example 1] The mold 1 shown in the vertical mold die-casting facility shown in drawing 6 at above-mentioned drawing 1 is set, and it is a rate of solid phase about a flake-graphite-cast-iron (3.2%C-2.12%Si) billet. Width of face which heats at 1200 degrees C of 0.2 and carries out die casting by the CHIKUSO cast method and which is shown in drawing 2 100mmx height 150mmx thickness The 6mm tabular product was manufactured. Moreover, die casting of the tabular product of this dimension was carried out by the CHIKUSO cast method in this way only metal mold (SKD61) for the comparison. The crack number of the tabular product obtained by carrying out die casting of every three sheets is shown as compared with drawing 3 . When the mold of this invention is used according to drawing 3 , it turns out that a crack decreases sharply. In addition, drawing 4 is the explanatory view showing the crack situation of a tabular product.

[0015] [Example 2] Width of face which sets the mold 1 shown in the vertical mold die-casting facility shown in drawing 6 like the above-mentioned example 1 at above-mentioned drawing 1 , carries out die casting of the spheroidal graphite cast iron (3.4%C-2.66%Si-0.03%Mg) by the CHIKUSO cast method, and is shown in drawing 2 100mmx height 150mmx thickness The 6mm tabular product was manufactured. Moreover, die casting of the tabular product of this dimension was carried out by the CHIKUSO cast method in this way only metal mold (SKD61) for the comparison. When the mold of this invention was used also in this example, the crack decreased sharply. And the microstructure after die casting was investigated in this example. The result is shown in drawing 5 . each at the time of carrying out the postheat treatment (heat-treatment conditions: 950-degree-Cx 15 minutes ->750 degree-Cx 3hr) of the drawing 5 c using the metal mold for a comparison (SKD61), when drawing 5 a uses the mold of this invention and drawing 5 b uses the metal mold for a comparison (SKD61) -- he is a microstructure.

[0016] When the mold of this invention is used, a cementite is not generated but it becomes a nodular graphite organization, so that clearly from drawing 5 , but when it will quench the liquid phase and it will become a hard

cementite organization, if metal mold (SKD61) is used like before, and it is heat-treated, it turns out that a graphite organization generates. It follows, and when the mold of this invention is used, the need for heat treatment is lost.

[0017] [Example 3] The mold 1 shown in the vertical mold die-casting facility shown in drawing 6 like the above-mentioned example 1 at above-mentioned drawing 1 is set. Change flake graphite cast iron (3.2%C-2.12%Si) and spheroidal graphite cast iron (3.4%C-2.66%Si-0.03%Mg) into a 1350-degree C molten metal condition, respectively, and die casting is poured in and carried out to a injection sleeve. Width of face shown in drawing 2 100mmx height 150mmx thickness The 6mm tabular product was manufactured. Moreover, die casting of the tabular product of this dimension was carried out in this way only with metal mold (SKD61) for the comparison. When the mold of this invention was used also in this example, the crack decreased sharply.

[0018]

[Effect of the Invention] As explained above, while according to the mold used for die casting of the cast iron concerning this invention generation of a hard cementite organization is prevented and being able to omit heat treatment of a cast iron product in a cast iron product, the crack at the time of die casting of a cast iron product can be decreased.

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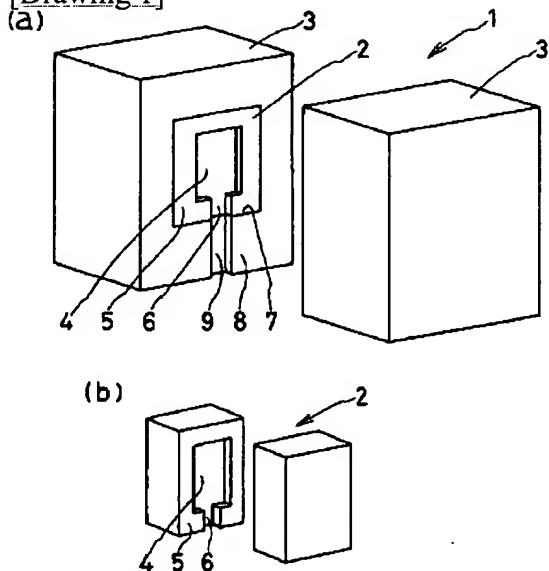
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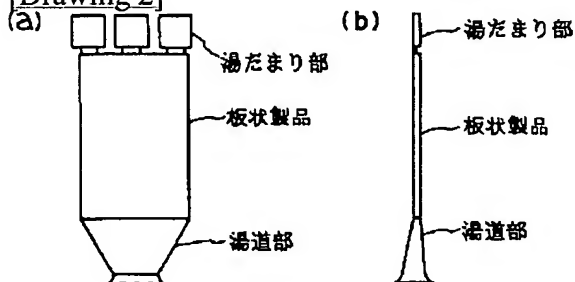
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## DRAWINGS

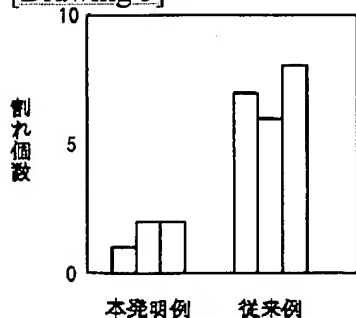
[Drawing 1]



[Drawing 2]

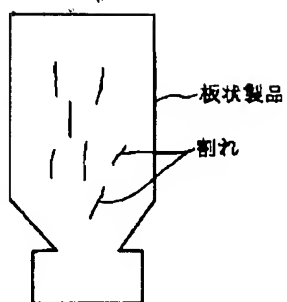


[Drawing 3]

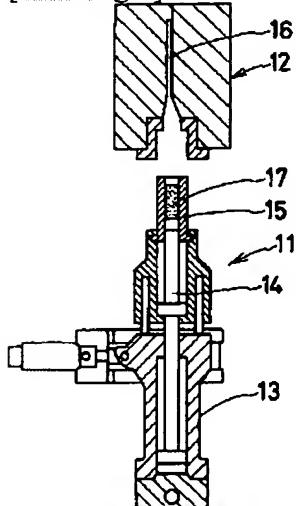


[Drawing 4]

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[Drawing 6]



[Drawing 5]

(a)

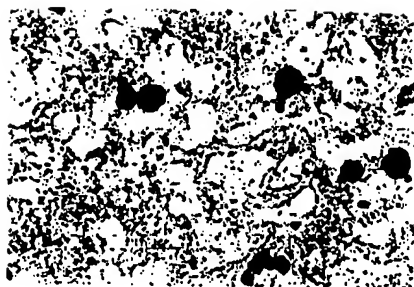


100μm

(b)



(c)



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## Patent Abstracts of Japan

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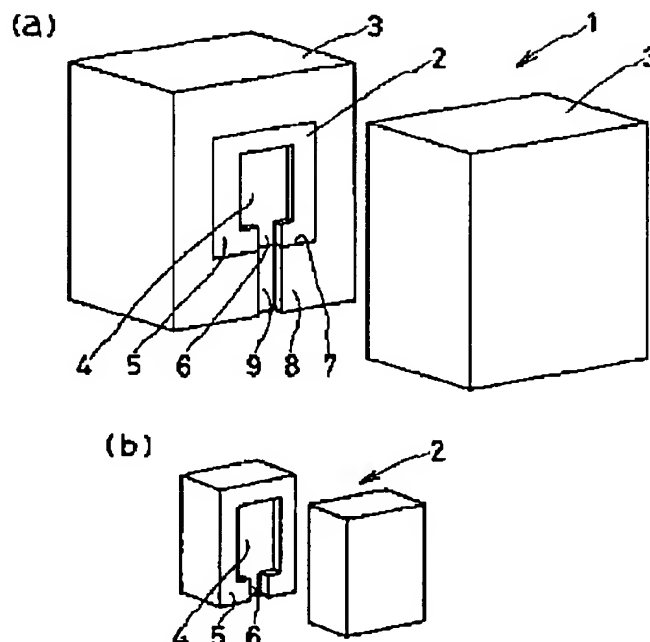
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APPLICATION NUMBER : 08044853

APPLICANT : KOBE STEEL LTD;

INVENTOR : ANDO YUICHI;

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TITLE : DIE TO BE USED FOR DIE CASTING  
OF CAST IRON



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